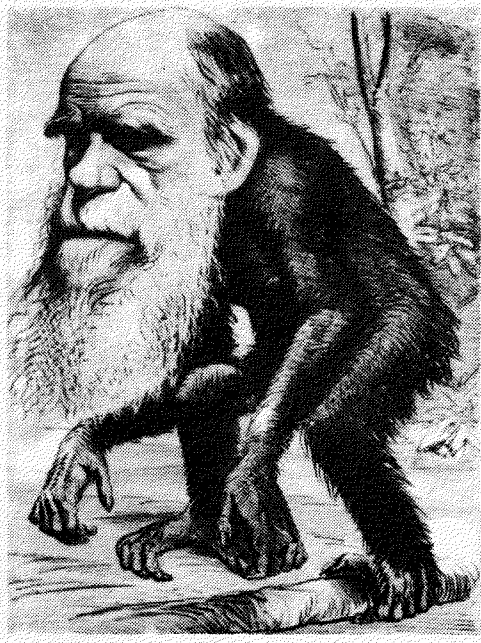

Issue V

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Cover photograph from the *Hornet*, March, 22, 1871. It ridicules Darwin and evolution.

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Defining "Kinds"—Do Creationists Apply a Double Standard?

Frank T. Awbrey

Creationists long ago gave up on their original idea of fixity of species. One reason is because simple calculation can show that Noah's Ark could not possibly have held pairs from each of some two to five million species (there would be less than one-half cubic foot per pair), nor could Noah and his family have possibly taken care of them all. A second reason is that the evidence for adaptive change and species formation is overwhelming. Therefore, they had to develop another concept.

Original Created Kinds

The current creation science stand on this matter is very nicely summed up by Dennis Wagner, editor of *Students for Origins Research*, in his answer to a letter by Dr. C. A. Zimmerman of Aurora College. Zimmerman asked whether or not creationists are "opposed to any and all evolution for any and all cases." Wagner defined three levels of evolution and stated that creationists object only to the third level—macroevolution—which leads to the formation of higher taxonomic categories such as genus, family, order, and so forth. He then said:

> The main thrust of the creationist belief is that there is a set of originally created kinds that were designed with a vast but limited potentiality for variation. This variation was gradually released through the degenerative process of inbreeding in which the offspring species never again reach the hereditary variability of the parent.

He proposed that the term *genus* should apply to the original created kind and finished with:

> Is the creationist opposed to macroevolution then? Well according to the definition of macroevolution, sometimes yes, sometimes no. If by macroevolution it is meant descent with modification of the coyote, wolf,

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> dingo, pampa fox, asiatic jackal, and domestic dog from the originally created Canid kind, then the answer is no, the creationist is not opposed to macroevolution. If, however, the definition of macroevolution means the descent with modification of the bird kind from the reptilian kind, then the answer is yes, the creationist is opposed to macroevolution.

Creationists do not have an exact definition of the original created kind for the same reasons that taxonomists cannot precisely define species: every imaginable gradation between species exists. Gish, a leading creation scientist, says that a basic animal or plant kind would include all species that have truly shared a common gene pool (1978). Furthermore, although no new kinds have arisen since the original creation, "the concept of special creation does not exclude the origin of varieties and species from an original created kind" (p. 40). In an article that first appeared in *Creation Research Society Quarterly* in 1971, F. L. Marsh says:

> The descriptions of kinds in Genesis I give us ground for hypthesizing that the individuals of any particular Genesis kind would have chemistries sufficiently alike to make them fertile *inter se*, but sufficiently different to make them incompatible with individuals of every other kind. If this hypothesis is valid, then ability to cross would demonstrate membership in the same basic type.

He then lists examples of plant and animal kinds, based upon "true fertilization," that is, whether or not "both reduced parental sets of chromosomes join and participate in the first division of the fertilized egg." In cases such as horses and asses, or dogs, coyotes, and wolves, the genus is the kind (or the *baramin,* as creationists call it). If members of different families within an order can be crossed, that order is the created kind, and so on. He admits that in some cases mutation and chromosomal rearrangements may have occurred that prevent interbreeding, but membership in a kind can be determined from external appearance as in fruit flies.

As biologists have recognized for over half a century, this is an objective and testable approach to the question of origins. An enormous amount of experimental hybridization has been done and is being done to help taxonomists assess relatedness in classifying many plant and animal species. Evolutionists interpret the results as strongly supporting the theory of descent with modification. Although creationists also appear to agree, within the limits stated by Wagner (1980) and Marsh (1971), they reject or ignore a large body of straightforward evidence that relates directly to the question of common descent and hybridization. Evidence is accepted by creationists only when it does not conflict with their beliefs.

Determining Genetic Relationship

An overwhelming body of experimental evidence clearly shows that the ability to

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form hybrids is strongly tied to the amount of genetic relatedness between species. Genetic relatedness can be directly measured by a number of techniques (Dobzhansky, *et al.*, 1977). Members of a local population exchange genes freely and are genetically very similar. On a scale of zero to one, their "genetic similarity" (one measure of the proportion of shared genes coding for essentially identical proteins) is 0.90 or higher. Some barriers to hybridization may exist between subspecies whose genetic similarity is about 0.8. Full species have genetic similarities ranging from 0.8 to about 0.3 and usually have substantial, if not complete, barriers to hybridization, and so on (Ayala, 1975).

Numerous studies show that chromosomal similarity is also a good measure of genetic relatedness. The fine structure of the gene-bearing chromosomes is an extremely complex pattern of bands and lines. The probability that two different chromosomes would independently arrive at identical banding patterns is essentially zero. Wallace details the evidence that identical chromosomes in two different species prove common ancestry just as surely as identical scratch patterns on two bullets prove both came from the same gun (1966). Even so, related species do not always have highly similar chromosome numbers or banding patterns because extensive chromosome rearrangements sometimes occur during speciation (White, 1978). Chromosome differences, when great enough, can cause the hybrids to be sterile, as in mules (Kaminsky, 1979), or to die as embryos, as in the cross between the domestic dog and the red fox (Chiarelli, 1975). If the differences are too great, the sperm will not even penetrate the egg. Conversely, the more similar the chromosomes of a sperm and an egg, the more likely their combination will result in Marsh's "true fertilization."

Evolutionists and creationists alike realize that all living species of a "kind" have inherited their genes from the same original ancestral species. Therefore, their body forms, chemistry, physiology, chromosomes, and genes are very similar. Conversely, the more similar any pair of species is for any and all of these features, the more likely it is they are descended from a close common ancestor and the more likely it is they can hybridize. If two species appear similar and are known to share most of their genes, creationists are usually perfectly willing to accept them as one "kind." If they are all interfertile, they are certainly one "kind." For example, asses, horses, zebras, and onagers all look rather similar. Their habits, behavior, diets, digestive systems, the proteins in their bodies, and the genes that manufacture those proteins are also similar. Moreover, the species in these four groups differ almost equally from other animals, such as rhinos. They form an obvious "natural group": the family *Equidae*. The final proof of their close relationship is that all are more or less interfertile, in spite of some differences in chromosome numbers (Ryder, *et al.*, 1978).

The general rule is that the higher the genetic similarity and/or the more similar the chromosomes of two species are in number and structure, the higher the probability that they can hybridize (Dobzhansky, *et al.*, 1977; Gray, 1971).

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Thus, even in cases where hybridization experiments have not yet been conducted, the likelihood of successful hybridization can be objectively predicted.

These objective criteria, for example, can be used to determine the relatedness of two ape species—the gibbon and the siamang—and, thus, how likely they are to be one "kind." They are easily distinguished, and taxonomists have placed them in different genera of the same family. These two species live together in Southeast Asia, but are not known to interact. The gibbon has twenty-two pairs of chromosomes, the siamang has twenty-five pairs. Their chromosome banding patterns have been so extensively rearranged that only one chromosome still bears a recognizably similar banding pattern in both species (Myers and Shafer, 1979). Their genetic identity, another measure of the proportion of their genes coding for essentially identical proteins, is 0.76 (Bruce and Ayala, 1979). No natural hybrids have ever been reported. Their separation into different genera seems morphologically and behaviorally justified. However, they are genetically as closely related as most rodent species belonging to one genus (Ayala, 1975). They appear, chromosomely, to be at least as closely related as horses (thirty-two chromosome pairs) and onagers (twenty-seven to twenty-eight pairs) (Ryder, *et al.*, 1978) or domestic dogs (thirty-nine chromosome pairs) and the red fox (eighteen to twenty pairs) (Chiarelli, 1975). Scientists view these observations as strong evidence for close evolutionary relationship. Since 1975, two hybrids have been born in the Atlanta, Georgia, Zoo (Myers and Shafer, 1979). Gibbons and siamangs unquestionably are highly modified descendants of a recent common ancestor, according to both evolutionist and creationist criteria.

Let us now apply these principles to another pair of mammal species. Their genetic identity is 0.70, about equal to the gibbon and siamang. Unlike the gibbon and siamang, their chromosomes are virtually identical even though one species has one pair of chromosomes more than the other. It is remarkable that 99 percent of the chromosome banding sequences of one species are clearly discernible in the chromosomes of the other species. The banding sequences are mostly in the same locations in the two chromosome sets, but in one species nine short segments are inverted, eighteen chromosomes have other minor changes, and one long chromosome has split to form two short ones, accounting for the different number of chromosomes. No hybrids have been found in nature, and no one has reported producing them in the laboratory. Nevertheless, if the proven criteria for genetic relatedness are objectively applied, these two species are merely one more example of close common descent or "variation within a created kind."

Few—whether evolutionist or creationist—would object to this interpretation if the species in question were fruit flies, horses, dogs, or even monkeys; but the two species involved are actually humans and chimpanzees (Bruce and Ayala, 1979; Miller, 1977; King and Wilson, 1975; Yunis, *et al.*, 1970). Evolutionists are not surprised, because these observations simply agree with previous fossil, anatomical, and embryological evidence. The picture suddenly changes for scientific

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creationists, however, because they are irrevocably committed to the tenet that humans are unique. All members of the Institute for Creation Research (ICR) must sign a statement of faith affirming their belief that humans were separately and specially created. The statement that humans did not evolve from an animal ancestor is ICR tenet number 4 and is incorporated in the ICR bylaws (Morris, 1980). This belief forces them to deny that all this evidence, which would be compelling proof of close relationship for almost any other species pair, has any relevance at all. A typical creationist reply might be that, at most, they show a common designer.

A Double Standard

The important question here is whether or not changing the meaning of evidence in cases where it conflicts with a belief is scientifically legitimate or intellectually honest. Accepting that a body of evidence infers common ancestry for flies, horses, cats, or dogs, but claiming that exactly analogous evidence infers nothing about human-ape ancestry is not sound scientific reasoning. It is blind prejudice. Creationists clearly reject evolution in this case not because there is scientific evidence against it but because it conflicts with a cherished belief.

When creationists finally acquiesced to the voluminous evidence that species had not remained absolutely fixed and unchanged since creation, they lost their war against the concept of evolution. Because the direct evidence for species divergence (that is, speculation) is so abundant and straightforward, "scientific" creationists had to accept it or appear as irrational as those who use the Bible to argue that the earth is flat. Creationists now argue that new species may arise within kinds, but that no species may change into a new kind. The question is: what limits divergence? Sheep and goats can hybridize. If one "kind" can diverge this far, why not as far as sheep and cattle or sheep and camels? If that far, why not further? Gene products and the genes themselves show no boundaries between kinds. All available evidence suggests that, as long as they reproduce, as long as their genes mutate, and as long as they are subjected to selection, species will continue to diverge, essentially without limit.

I suggest that creationists made a tactical error when they began to pay attention, albeit selectively, to scientific evidence. This is because that evidence actually contradicts their most sacred belief: the belief that humans are uniquely created. Even if "true fertilization" between human and ape were reported, would scientific creationists reject special creation and accept the evolutionary relationship of humans and apes? If they were rational practitioners of science they would.

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Why Scientific Creationism Fails to Meet the Criteria of Science

Ralph W. Lewis

The supposed conflict between science and religion as set forth by modern creationists cannot be evaluated unless one knows certain characteristics of scientific knowledge and compares them with certain characteristics of religion. This comparison leads informed, rational people to conclude that creationism is not a part of science and that the conflict between science and religion is not very significant. The unlimited ranges of religious experience, for those who grasp them, are bound to make the limited ranges of science seem small. Thus, any conflict—apparent or real—will be small or nonexistent.

Scientific Knowledge

In order to understand the limitations of science, one needs to know some general characteristics of scientific knowledge and a few things about the record of works that developed this knowledge.

Scientific knowledge is organized around many hundreds of sets of ideas. The number of ideas in a set is few, usually from five to ten. A theory consists of one set of ideas plus many facts plus many lines of reasoning by which facts are used to support the ideas and by which facts are explained or predicted. The ideas, often called postulates, are human made and are established, by consensus, through the centuries. Ideas about the mystical and the supernatural are excluded from science.

All reasoning in science hinges around sets of ideas which are assumptions about nature. If the ideas seem reasonable in light of the facts available, if the ideas make it possible to explain many facts, and if the ideas make it possible to predict facts that are not yet known, then we say that we have a good theory. The ability to explain and predict facts leads scientists to think there is some truth in the ideas. But scientists aren't satisfied. Truly, they are obligated by their discipline *not* to be satisfied. When possible, they question and test the ideas directly. They question the explanations of facts that others have given. They make predictions and test them by extensive observations and experiments. And

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they continue these operations until they have (1) disproved a theory, (2) changed the theory by modifying its assumptions, or (3) established the range of its applicability and limitations.

Theories, even the best of them, are never universal, perfect, or complete. Each theory applies to a limited range of human experience and, even within this range, it may be impossible to make certain kinds of predictions because the theory is too imperfect. With large theories it is impossible to follow out all of the logical consequences or predictions because of the limited time, tools, and resources available. Large theories are always incomplete.

A theory which has become widely accepted has a history recorded in the scientific literature. In order to decide if a theory is truly scientific, one must be able to find adequate answers to questions like the following.

1. What are the names of the people who have spent years of time developing and testing the theory by field work or laboratory experiments?
2. What is the reference to the paper or book in which the theory was first published?
3. What are the references to papers in which the various aspects of the theory were tested?
4. What are the references to papers which describe applications of the theory that show its capacity to explain facts?
5. What are the references to papers that describe substantiated predictions derived from theory?
6. What are the references to papers that delimit the theory and show its limitations?

The work described in these kinds of papers must meet the rigorous standards of accuracy, clarity, and logicality typical of science.

Descent with Modification

In order to illustrate some aspects of science described above, let's examine the theory of descent with modification. This theory is one of the major theories of evolution. The other, which deals with mechanism of evolution, is the modern modified form of the theory of natural selection. The postulates of the descent theory are as follows:

1. All life evolved from one simple kind of organism.
2. Each species, fossil or living, arose from another species that preceded it in time.
3. Evolutionary changes were gradual and of long duration.

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4. Over long periods of time, new genera, new families, new orders, new classes, and new phyla arose by a continuation of the kind of evolution that produced new species.
5. Each species originated in a single geographic location.
6. The greater the similarity between two groups of organisms, the closer is their relationship and the closer in geologic time is their common ancestral group.
7. Extinction of old forms (species, and so forth) is a consequence of the production of new forms or of environmental change.
8. Once a species or other group has become extinct, it never reappears.
9. Evoltuion continues today in generally the same manner as during preceding geologic eras.
10. The geologic record is very incomplete.

The postulates set the major limitations of this theory as they do with all theories. The theory is concerned with living and fossil organisms. It is concerned with changes that occurred in living organisms through the vast reaches of geologic time. It is not concerned with cosmic evolution, inorganic evolution, or human cultural evolution. It is not concerned with the origin of life, because it assumes the presence of a simple form of life in the beginning and it says nothing about where this simple form of life came from. Other theories in biology deal with that subject.

Postulates 7, 8, 9, and 10 can be individually tested by searching for evidence. Paleontologists have studied extinction in the fossil record and can in some cases account for it in terms of geologic changes. Extinction of species has occurred quite frequently during the past century, so biologists know something about it. Extinction of subpopulations of species is an active study in ecology today. In general, the facts support postulate 7.

Postulate 8 is well supported by the fossil record, and strong indirect support has come from the growing understanding of reproduction and inheritance in terms of the genetic substance DNA. Postulate 9 is supported by many field and laboratory studies in microevolution and by the origin of a few new species in nature during the past century. Postulate 10 has gained support by the increase in knowledge of the fossil record, but it has been questioned to a degree by the development of the theory of allopatric speciation. So postulate 10 might be restated thus: "The geologic record is incomplete in part because the major steps in evolution occur rapidly (on the geologic time scale) in quite small subpopulations of species." This illustrates how scientists may modify the postulate of a theory. Postulate 3 is somewhat modified by this restatement of 10, but still stands to the extent that we recognize that gradual and rapid change measured in geologic time is of long durations when measured in terms of years or centuries. In geologic time, *rapidly* could mean hundreds of thousands of years instead of millions of

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years, but this kind of rapid change is still of "long duration" by the time standards of daily existence.

Despite these modifications, most aspects of the theory stand as before. Postulates 1, 2, 4, 5, and 6 gain their support indirectly as a part of the functioning of the whole set. So we find in the study of the geographic distribution of living and fossil organisms, in taxonomy and phylogeny, and in paleontology that there are hundreds of successful subtheories of the descent theory. This means that each subtheory uses the ideas of the descent theory explicitly or implicitly in its reasoning and applies them, along with an additional set of postulates, to a limited situation. Since it is possible to construct these rational patterns of thinking—these subtheories that are acceptable to biologists—each new successful subtheory adds support to its superior theory: the descent theory.

Because the descent theory provides the basis of explaining many facts, such as the biochemical unity of life and the distribution of fossils in geologic formations, and because it has spawned hundreds of subtheories which in turn have made it possible to explain and predict thousands of facts, the descent theory is a fruitful theory. Fruitfulness is the major criterion of the goodness of a theory. Since the theory of descent with modification and the accompanying theory of natural selection have been exceedingly fruitful, and since they encompass millions of facts and lead to the discovery of thousands of new facts each year, they are accepted today as the major theories in biology.

This acceptance does not mean that biologists don't question all aspects of the evolution theories. The discussion of postulate 10 above is an example of this questioning. If a biologist could imagine a better theory that would replace the descent theory, he would do it immediately because he looks at all theories as tentative, humanmade intellectual constructs to be manipulated by thinking people. He does not consider them to be universal truth and wisdom.

Science and Religion

One great difference between science and religion is religion's fundamental concern with beliefs that are accepted on faith, whereas science is concerned with humanmade ideas that are tested in various ways, sometimes discarded, often modified, and always of limited applicability—that is, they do not purport to be universal or absolute truth. Although many ideas in science remain in science for a long time, their limitations are ultimately discovered and they may become subsumed under a new set of ideas that, in turn, has its limitations. Religious beliefs do not function in the tentative, limited way of scientific ideas.

Since religious beliefs are not accepted as tentative, humanmade ideas and since science excludes mystical and supernatural ideas or beliefs from its sets of ideas, anyone can see that relgion and science belong to two vastly different

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realms of thought. They are as different as poetry and accounting or architecture and horse racing, or beefsteak and sand. If we wish to stretch at the fringes, I am sure we can find some conflict between the members of these pairs. But will the conflict be of any lasting significance? Life contains many excellent realms of thought that cannot be completely reconciled or integrated. Does this necessarily mean that some of the realms are wrong or bad? No, it simply means they are different.

If biologists consider their theories to be tentative, limited, and incomplete, why do they look with such disfavor at the so-called theory of "scientific creationism" as set forth by a group of creationists? They do this because, in the first place, the creationists' postulates include ideas about the supernatural, and scientists long ago decided that in their limited fields of scientific thought, observation, and experiment they could not successfully use supernatural and mystical ideas. Second, the creationists' theory does not meet the rigorous standards that accompany the growth of an acceptable scientific theory.

One can search without success for references to papers that would answer the above questions as applied to the theory of "scientific creationism." To my knowledge, there is not one practicing biologist who has been active for years in field or laboratory research and who has published papers that describe work designed to test the postulates of the creationist theory or to test the logical consequences of that theory. Thousands of such papers by hundreds of biologists have been published on the theory of biological evolution, and these can be cited to provide answers to the above questions. See *Evolution, Process, and Product* by Dodson and Dodson for these references.

On the above grounds, one is forced to say that *scientific* creationism does not exist, and those who do say so are being misled by their ignorance of science and their ignorance of the criteria by which scientists decide what constitutes science. If people choose to hold beliefs or ideas outside of science which cause them to reject scientific ideas and theories, they are exercising their rights in a free society. And in a free society, these people have the right to try to influence others to accept their views. But if, through ignorance or chicanery, these people try to propagate an untruth such as the notion that there is a *scientific* theory of creation, they are posing a false conflict.

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The Bombardier Beetle Shoots Back

Robert E. Kofahl

Christopher Weber claims he has exploded the Bombardier beetle myth, because he has found factual errors and logical deficiencies in the argument for creation developed around this clever little creature (1981). Well, they say that confession is good for the soul, so I had better confess. I am the source of the original little pamphlet about the Bombardier beetle which was published way back in the early sixties. My first information was from an article in the science page of *Time* magazine (1961) and then a follow-up of Hermann Schildknecht's first research article which was published in *Angewandte Chemie* in 1961. My translation of this article was cursory, rather sloppy, and the idea of spontaneous *explosion* of the beetle's hydrogen peroxide-hydroquinone mix came from the *Time* article. So please don't lay so much blame on Dr. Gish. I must accept responsibility for the misinformation.

Having said this, however, it does appear to me that Chris Weber has not proved his case very well and, therefore, our case still stands. In fact, he ignored or overlooked some basic facts that his readers really ought to know if he claims to have demolished our case.

It is true that a mixture of the two reactants dissolved in water does not spontaneously explode, but Dr. Schildknecht noted that the mixture is quite unstable in vitro and begins to react immediately. He also reported some experimentation with the mixture stored in the reservoir. It seems that the mixture of hydroquinones and hydrogen peroxide remains stored indefinitely in the reservoir without reacting, preserved in a clear water-white condition. He says:

> It is thus astonishing that the content of the pygidial gland remains completely colorless in the interior of the bag. This may be investigated if one keeps an isolated pair of pygidial glands together with a moist cotton pad in a small weighing bottle. The contents of the bag remain water-clear for a long time. When after up to two days the bag begins itself by subsequent decomposition to become colored black, there is still to be noted no decomposition of its contents, which, after four days, always still is in reaction-ready condition, as the violent effervescence with formation of quinone and oxygen caused by touching the bag, by this time strongly decomposed, demonstrates. . . .
>
> In comparison it may be shown by experiment that the phygidial bladder

---

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contents are stable only in the interior of the bladder and spontaneously decompose in a brief time, if one withdraws it from the bladder, perhaps by puncturing the inactivated bladder with a fine capillary.

According to these investigations, there is a principle active in the biological system that a solution of hydroquinone and hydrogen peroxide is stabilized. This principle is either chemical or physical chemical in nature, but it appears to be connected with the morphology of the collection bladder of the pygidial gland system. Stabilization by a homogeneous chemical stabilizer distributed in the solution appears improbable.

Now let us analyze this defense system from the evolutionary viewpoint. Mr. Weber makes it sound all too easy. Within the framework of his preliminary speculations, we have to imagine a beetle which merely was a stinker, dripping hydroquinones from his anus to be as unappetizing as possible, which would certainly have an adaptive value. But then, somehow, some hydrogen peroxide began to get mixed with the hydroquinone. This was supposedly advantageous, so that gradually natural selection led to increased peroxide content. At first the two compounds reacted until the peroxide was used up. Now this might be advantageous, since the resulting quinone would be an irritant to enemy predators. So now the beetle both stank and burnt the mouths of predators. But then, by chance, a still unknown mechanism developed—either all at once or slowly—which prevented the reaction. This would supposedly provide some unknown advantage greater than the previously described advantage of having the reaction take place. Then, gradually, the gland or glands producing the two reactants evolved the power to produce greater and greater concentrations of a stable mixture of hydroquinones and peroxide, eventually reaching 10 percent and 23–25 percent, respectively. This process supposedly had some progressively advantageous value to the beetle.

Schildknecht points out that it is reasonable to imagine that in the biochemical production of each two moles of hydroquinone from quinone, a natural by product would be one mole of oxygen (molecular), and that this could be converted to one mole of hydrogen peroxide. This would yield a weight ratio for hydroquinone to peroxide of 6.5 to 1. But in the stored liquid produced by the beetle's pygidial glands, the ratio for hydroquinone to hydrogen peroxide is 1 to 2.4, an almost fifteen-fold excess of peroxide. This is apparently needed to get both oxidation explosively of the hydroquinone and a large amount of oxygen gas to provide extra propulsion force for the defensive charge. It seems that evolution is always thinking ahead?

Returning now to our developmental train of thought, in the meantime, or at some subsequent time, the vestibule developed with attached glands producing the two enzymes necessary to produce an explosion when mixed with the hydroquinone-peroxide solution. But presumably in the early evolutionary stages the amounts of the enzymes would be small and the concentrations of the reactants

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also small, so no explosions would occur. Perhaps the beetle just walked around with its stinking behind getting gradually hotter and hotter. Maybe it got too hot back there, so it became advantageous for the beetle to evolve the muscle and valve to shut off the reservoir from the vestibule containing the enzymes. Then the beetle would find it advantageous to squirt out short spurts of the mixture which would explode in the vestibule, once the concentrations all got properly balanced. Of course, until controlled explosions became possible to the beetle, there would be no need for the aimable orifices or guns that are now attached to the vestibules of the beetle. So we might speculate that the earlier forms of beetles of the genus *Brachinus* used shotguns which were not very efficient. Greater efficiency was gained by evolving the shotgun barrels into rifle barrels. Then the beetle could shoot his enemies by aiming his rear end at them and pulling a trigger mechanism which he had just happened to evolve in the nick of time. It would be pretty bad when the robber walked in if the hero found his gun did not have a trigger or if he had not learned how to aim it. Later it became advantageous for the twin rifles to be installed in moveable turrets so that they could cover an arc of 270 degrees. And this all by spontaneous materialistic process!

It does seem to me that to believe such a scenario is credible requires strong faith in the capabilities of atoms and science, but those who believe in evolution have such a faith. Those who believe in creation likewise have strong faith. The difference is that they place their faith in a Being of infinite intelligence and power whose intelligent, purposeful designs are evident everywhere in nature.

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Note

Translations from the German are due to the author, with trepidation.

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Response to Dr. Kofahl

Christopher Gregory Weber

Dr. Robert E. Kofahl's critique does correct a minor error I made, although my main argument still stands. The main point of my article was this: If Dr. Gish is careless where I can check up on him, then how can I trust him where I cannot? In addition, I did try to show that Dr. Gish had failed to prove that a pre-bombardier beetle could not have survived, though this was an afterthought in order to make the article complete.

As the bombardier beetle information trickled from Kofahl to Gish to Thwaites and Awbrey to me, somewhere along the line someone forgot about Schildknecht's 1961 article which was quoted by Kofahl. When I wrote my article, I found no reference to any inhibitor in Schildknecht's 1968 article, but Kofahl is correct that Schildknecht, in 1961, did speculate that some chemical or physical-chemical process prevents the hydrogen peroxide and hydroquinone solution from reacting and turning dark. On that issue I stand corrected.

However, even after this point is granted, my case against Dr. Gish still stands. Dr. Gish maintained that the hydrogen peroxide and hydroquinone explode unless prevented by an inhibitor long after it was pointed out to him that these chemicals do not spontaneously explode. Even if Schildknecht's speculation is correct, all the inhibitor prevents is slow oxidation. Kofahl was gracious enough to admit an error, and I admit mine; but Gish's failure to admit *his* error supports the main thesis of my article.

Dr. Kofahl spends more than half of his critique trying to prove there is no way the bombardier beetle could have evolved gradually. All I can say is that Kofahl does not really try very hard to solve the problem. There are several weaknesses in his critique.

The main weakness is that he asks me to explain how the beetle could have evolved the mechanical apparatus *after* it got through evolving everything else. However, as I already explained in the article, the bombardier beetle is not the only carabid beetle to have this apparatus.

In 1968, Schildknecht said:

> Not only among the brachynids [that is, the bombardier beetles] but also among other carabids—like, for example, among Carabus—annex glands

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Christopher Weber, one of the editors of this journal, is a computer programmer and an amateur geologist. He has followed the creation-evolution controversy for many years.

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> empty in the output canal of the pygidial bladders. What substance is produced here we have not yet investigated. If the function of these glands that was first explained in the case of the bombardier beetle is not found in the other carabids, then it is to be suspected that they produce albumin likewise. To be sure, its purpose still remains unclear.

Since carabids generally have such poison glands, we may justly reject Kofahl's evolutionary scenario and begin ours with a nondescript carabid beetle that already has the physical apparatus, even though the apparatus does nothing more than secrete poisons such as quinone and hydroquinone. The hydroquinone stank, and the quinone (which forms from hydrogen peroxide and hydroquinone) burned; so this beetle survived quite well. It had a valve to hold the chemicals in the collection bladder until it was attacked by an enemy, and it had enzymes in the outer chamber to make sure the reaction of hydrogen peroxide and hydroquinone was complete.

All it would need to become a bombardier beetle now is an inhibitor to make sure the chemicals did not react at all until used in a counterattack. If the chemicals did not react at all until forced into the outer chamber, then the enzymes there would force them to react very rapidly, and the oxygen coming from the reaction would spray quinone out of the beetle's rear end. Later on, the mechanism would become refined as the beetle obtained the ideal proportion of hydroquinone to hydrogen peroxide. (Despite what Kofahl says, there may well be more than one chemical mechanism for producing hydrogen peroxide; Schildknecht suggested one *possible* mechanism, but scarcely insisted that this is the only one.) Thus, we have seen how a carabid beetle could evolve into a bombardier beetle with little problem.

At this time, I shall not try to explain the "rifle barrels" of the bombardier beetle, since I don't have enough information on the matter. I don't have the anatomical details to determine how the barrels and turrets evolved or what previous organs they evolved from.

The present discussion, however, answers Gish's original argument that a half-formed explosion mechanism would be harmful and that the bombardier beetle's very existence proves evolution is impossible. But, creationists will no doubt object that I have not directly proved my scenario. True enough, but they should consider a few facts before dismissing it out of hand as pure speculation.

The evidence of geology makes sense if the earth is billions of years old, but is puzzling if creationism is true. The evidence of taxonomy makes sense if some sort of descent with modification took place, but is puzzling if creationism is true. If you *want* to believe in miracles, I can never prove you wrong, any more than I can prove that bad luck gremlins did *not* produce the incriminating evidence that got Bruno Hauptmann convicted of kidnapping and murdering the Lindberg baby or prove that the earth was *not* created five minutes ago. However, the most *natural* interpretation of this evidence is evolution—the theory that living things

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change over time, one lineage often branching into several lineages, some lineages changing more rapidly than others. I certainly don't deny that catastrophes have occurred or that the *mechanism* of evolution is still being debated, but the *overall* picture of *occurrence* of evolution seems clear.

So, given this background, isn't it reasonable to start out with the working hypothesis that the shooting mechanism of the bombardier beetle evolved gradually, then find out what evolutionary scenarios would work? Starting with creationism is to start with a refusal to search further. Think about it.

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Genetics and Genesis: The New Biology Textbooks that Include Creationism

Henry P. Zuidema

Let's take a trip back in time to 1933. The Scopes trial is already history. The Moral Majority and television evangelism are not yet on the horizon. And a high school student, opening a standard biology text by Macmillan, can read:

> Charles Darwin's *Origins of Species* has replaced the concept of special creation with the theory of organic evolution. At the present time, biologists accept evolution as a fact but are actively engaged in efforts to discover how it has taken place.

There is no hue and cry, no complaints about the alleged lack of evidence for evolution, even though gene splitting is far off and DNA has not been discovered. Letters of protest do not pour into the newspapers. Boards of education do not patiently listen to committees of objectors demanding "equal time" to reply to "the religion of evolutionary humanism" in the public schools.

Today, nearly half a century after the above textbook summation of evolution, and others like it, went unchallenged, a new crop of textbooks is on the market. A paragraph from one of them begs citation:

> Darwin asked some interesting questions and set forth a thought-provoking hypothesis about which people are seeking new clues in the light of modern science.

Better not name what that "thought-provoking hypothesis" was. Today's writers now play it safe. The "book-watchers" are watching! The 1973 index in *Biology: Living Systems* (Charles Merrill) gave seventeen lines of page references under evolution. By 1979 the subject was indexed in just three lines.

In some of the texts, "Darwin" is left out, too, particularly those of the past decade. *Biology: Patterns in Environment* (1972) and *Biology: Patterns in Living Things* (1976), both in the Harcourt Brace series, are two examples. In another,

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Henry Zuidema, Detroit Science Center paleontologist, is also a science writer and former editor of Earth Science. *In 1947–1951 he discovered the Ruby Valley (Montana) fossil insect and plant locality.*

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Concepts in Science (1970, second edition), only George, the son of Charles Darwin, is mentioned. But in the third edition, the dilemma has been solved by eliminating the name Darwin entirely. (The equivalent would be a physics text which neglected Faraday, Rutherford, or Einstein or an astronomy book that skipped Copernicus.)

And as evolution slips away, creationism slips in. Though sometimes handled in an apologetic way, special creation now has a place among photosynthesis, metabolism, and symbiosis in the new breed of public school texts produced by major secular publishers. Much of this is done by indirection. "Why do you think many people believe that the earth and its life must have been created by a divine creator?" asks a California text. "Egyptians attributed the original creation to the god, Nun," the book adds. "In Babylon, it was believed the god Marduk created heaven and earth from the body of an evil dragon-goddess. Some American Indians thought that the sun-coyote created earth." No doubt this is interesting, but is it biology?

In *Biology: The Science of Life* (Houghton Mifflin, 1980), the text writer discovered a book written in 1849 by Scottish quarryman and popular writer Hugh Miller, who thought that, after successive divine creations, as of the reptiles and mammals, "the world we inhabit took beginning. And then creation ceased." On a later page in this text, the writer tells us that "in the Christian tradition the special creator is God," but "special creation appears to be an untestable explanation or hypothesis. The subject matter in this book is limited to what can be known by using the method of learning called scientific inquiry. From that point of view, special creation is an explanation that is neither right nor wrong. It is scientificaly untestable, so far as we know."

Among the leading publishers interviewed by *Bioscience* in 1979, one said that in his company's text "evolution runs like a thread throughout, but is mentioned specifically only in the last chapter." This is where creationism is also noted. It is regarded as a "theory" opposing evolution, but "just briefly enough to be discarded as unverifiable and therefore beyond the scope of the textbook's area." This publisher added that the final chapter is most likely to be ignored by teachers anyway, as it wouldn't come until near the end of the term.

"We don't advocate the idea of scientific creationism," says Lois Arnold, senior science editor at Prentice Hall, "but we felt we had to represent other points of view." A text writer who wants to remain anonymous admits, "Creationism has no place in biology books, but, after all, we are in the business of selling textbooks."

All this has confounded specialists in the life sciences who have been updating biology books, as through the Biological Sciences Curriculum Study, ever since science teaching in this country became the object of scrutiny (after Sputnik in 1957). They feel the big publishers are doing them in.

"With the exception of a few publishers," reads the summary of a survey of

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the new books by a curriculum committee, "others seem to have accommodated to the situation either by eliminating what they regard as contentious material, soft-peddling or reducing their evolutionary coverage, or introducing nonscientific theological materials as science in the hopes of placating the anti-evolutionists."

The creationist ferment comes at a time when the near $1-billion-a-year textbook industry has its problems. As one industry observer states:

> Enrollments in high school biology have been high as students who do take science tend to take that subject rather than physics and chemistry. As a result nearly every publisher in the field has come out with a new text, and the competition is fierce
>
> Some publishers will take every opportunity to eliminate any material that might mitigate against sales. Textbooks are getting to be too expensive to produce and market to foster any but winners. And the era of the independent publisher is coming to a close. Most firms now are part of conglomerates. Holt and Saunders, for example, belongs to CBS, and Charles Merrill is a part of the Bell and Howell empire. E. P. Dutton, already the property of a holding company, is up for sale after 127 years. Others have simply pulled out of school publishing entirely to get into other publishing interests.
>
> With emphasis on the bottom line becoming more pronounced, more accommodation with special interests will be reached. Textbooks then will no longer reflect the state of the discipline, but, like television, will pander to those who make the most noise.

However, there are dissenters in the trade. "Once you have done that [put creationism in a text] you have let the cat out of the bag," says one of these. "In fact, if I found such a reference in a competitor's book, I'd make sure everyone knew about it."

But such references are not now difficult to find. One specialist in the study of biology texts, who has reviewed a score of them, says, "This has made the Institute for Creation Research unnecessary. It plays right into the hands of the anti-evolutionists."

Eugene Wheetley, editorial vice-president of Scott, Foresman, warns that the creationist campaign reaches into other disciplines besides biology "and over the total grade level spectrum." Since some creationist leaders see the very structure of modern society threatened by "Darwinism," it is not surprising that one of these, scrutinizing modern literature, objects to the intrusion of "survival of the fittest," which he senses in Jack London's *Call of the Wild*, and the reference to historical geology in James Mitchener's *Centennial* (because it implies a vast age for the earth).

There will be further litigation, Wheetley believes, "if the recent ruling in California is any indication," referring to *Segraves* v. *California*, in which the court held that the teaching of evolution did not violate the rights of fundamen-

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talist children, but also upheld the state "guidelines" which, in effect, caution publishers to watch their language in dealing with evolution.

And California, accounting for about 10 percent of the national textbook market, is closely watched by the publishers. A rejection of a book in that state can influence buying elsewhere. In this sense, an MIT-Cornell sponsored survey ventured that California has an influence on science education across the country, as the publishing of texts to fit regional perferences is uneconomical.

Creationists in general are quite obviously cheered by these recent developments. John N. Moore, a "born again" professor of natural science at Michigan State University and a founder of the Creation Research Society, called the attention of a citizen's group to the appearance of the new texts, naming among these *Biology: An Inquiry into the Nature of Life* (Allyn and Bacon).

The Allyn and Bacon text pairs creation concepts with those of evolution in adjoining columns. One reads: "Creationists say . . . the theory of evolution need not be accepted simply because most scientists support it," but "evolutionists say . . . agreed. Evolution should be accepted only as long as the evidence supports it." The several approaches to evolution inquiry are then cited, and the column ends with "Creationists say . . . evolutionists deny the creative power of God," and "evolutionists say . . . the hand of God is just as evident in evolution extending over billions of years as in creation occurring in an instant or a few days."

Stanley Weinberg, the author of that text, who has been active in opposing creationist attempts to have legislatures pass laws that would enforce equal teaching of creationism with evolution, said that Professsor Moore did him a disservice by describing his text as taking up creationism without describing the method of treatment. "I do indeed teach *about* creationism," Weinberg said, "but I do not support it. Creationism should be taught because it is an important part of the history of biology and it is a topic of growing political importance. It would be well if students got some information on it in school rather than exclusively from creationist propagandists. Further, the creationists are fully entitled to criticize evolution theory."

Other texts named by Professor Moore as being in use were *The World of Biology* by P. W. Davis and E. P. Solomon (McGraw Hill) and *The Science of Evolution* by W. D. Stansfield (Macmillan), this latter being for college students.

Moore, who teaches a mix of creation and evolution principles, has a special interest in the appearance of the new texts, as he is coeditor of a creationist biology book which caused controversy in Texas and Indiana. In 1975, this book, *Biology: A Search for Order in Complexity* (published by Zondervan, a fundamentalist publishing house), was chosen as one of seven officially approved biology texts by the Indiana state textbook commission. In two of Indiana's districts, it was the only ninth-grade biology text available to students.

But an Indiana court later barred the book for use in public schools in that

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state on the grounds that it was sectarian-based. In Dallas, Texas, a committee of Protestant, Catholic, and Jewish clergy opposed it there and, in a compromise, got it relegated to library use as a reference work. Still, by the time of the Indiana court decision in 1977, Moore's book had already been approved by state commissions in Alabama, Georgia, Oklahoma, and Oregon. This book is still being pushed by the Institute for Creation Research.

That the general controversy continues to rage is indicated by the plethora of recent battles that have taken place all across the country since the end of 1980. But curriculum specialists and school administrators view the few successes of the creationists, as in Arkansas, to be due to lack of awareness on the part of teachers' groups and regional science academies. "They were," says an observer, "asleep at the switch when the 'equal time' bill was railroaded through the legislature. Such regional developments may not represent the sentiment of the nation at large. The publishers have made their big investment in the gamble. it remains to be seen if they misjudged the national consensus by reviving the old arguments that were rather well relegated to their respective spheres of human thought—religion and science—in the nineteenth century.

Response to Zuidema

Stanley Weinberg

Henry Zuidema's article on the treatment of creationism and evolution in biology textbooks refers to, among others, one of my books, *Biology: An Inquiry into the Nature of Life* (1977). His references to my work are accurate but incomplete, and this incompleteness—perhaps understandable in view of space limitations in journal articles—makes impossible a fair evaluation of the book. Therefore, I welcome the editor's invitation to comment on Zuidema's article.

Zuidema goes beyond the evaluation of particular textbooks. His references to aspects of publishing and to science-teaching strategies are calculated to pro-

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Stan Weinberg has thirty years experience as a high school and college biology teacher and is the author of several textbooks. He has served as vice-president and director of the National Association of Biology Teachers and as president of the New York Biology Teachers Association.

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ERRATA

After this issue had gone to press, a two-model creation bill was signed into law on July 21, 1981 in Louisiana. It is as strict as the Arkansas law, and the ACLU is acting.

Change the word "speculation" in Dr. Awbrey's article, page 5, next-to-last paragraph, 4th line, in parenthesis to "speciation."

The cover picture is from the Hornet of March 22, 1871. It ridicules Darwin and evolution.

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voke discussion and, therefore, make a useful contribution. I will make no comment on books other than my own.

Zuidema and I have different perspectives. He is a geologist and a journalist. He admittedly has no teaching experience below the university level (Zuidema, September 3, 1980). I taught biology for thirty years, mostly in high school, but also as an adjunct in several colleges. Therefore, we approach the issues from different backgrounds, and these differences show.

A Description of the Text

Of the thirty chapters that comprise *Biology: An Inquiry into the Nature of Life*, five are concerned entirely or largely with aspects of evolution. Evolution appears in many other chapters as well and, indeed, is a theme throughout the book. Thus, the coverage of evolution, in extent and depth, is at least comparable to that in the Biological Sciences Curriculum Study (BSCS) versions and, I believe, is substantially greater than in any other high school biology text. So, the book cannot be said to slight evolution. By not making the least mention of this feature in a report that purports to deal with textbooks' treatment of creation and evolution, Zuidema misrepresents the nature of my book.

Chapter fifteen, entitled "The Origin of Species," is mainly a thorough exposition of Darwinism and neo-Darwinism. The chapter also includes a discussion of creationism, perhaps the most extensive in any evolution-oriented textbook. A brief history of the creation-evolution controversy, from the period preceding Darwin through the more recent Scopes and Epperson cases, is included. This historical treatment conforms to a second theme that runs through the book: demonstrating the changing and ongoing nature of science by describing the historical development of various fields of biological inquiry. The rationale and demands of the creationist movement are described. There is also a table presenting creationist arguments against evolution and the responses of evolutionists.

No theory of creationism is presented; to my understanding, no such theory exists. There is no support for creationism. Indeed, the book says:

> As a result of Darwin's work, scientists generally came to reject special creation. Then and now, most biologists have accepted the theory of evolution through natural selection as the only reasonable explanation for the origin of different kinds of living things.

Despite this clearly stated position, Zuidema not only seems distressed by the mere discussion of creationism in a biology text but is especially distressed by the comparative table.

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I view "scientific creationism" as a religious doctrine posing as science, not as an authentic scientific theory comparable and equivalent to evolution. I oppose requirements that mandate the teaching of creationism, with its supernatural base, in the public schools. In view of this position, why do I incorporate *discussions* of creationism in my textbooks and in my teaching? This question is explicitly answered in the book in a statement directed to the students:

> The issue of creation versus evolution concerns you not just as a biology student but as a citizen and a prospective voter. You may have to help decide what should be taught in the schools of your state and your community.

A View of Science Education

The creation-evolution controversy is not a *scientific* issue, but it is a *public* issue of considerable current significance. It is generally recognized that the high school's basic function is general education, not technical specialization, and that high school courses are obligated to educate not only in their respective disciplines but in language skills and citizenship as well. I regard discussion of creation-evolution as education in citizenship. Therefore, I do not subscribe to the notion put forth by Zuidema and certain other pro-evolutionists that *any* discussion of creationism in science classes—or in science textbooks—is *verboten*. The real question is not *whether* creationism should be discussed but *how* it can be handled with accuracy, fairness, and responsibility. Let me address this question.

It is an axiom familiar to all competent teachers that to reach the kids at all we have to address their real concerns. *Felt needs* was the term used by the Teachers College school. The BSCS guidelines (1978) state this well-established pedagogical truism in somewhat more formal language: ". . . information that has important personal implications for the learner is inherently more interesting and learned more thoroughly than isolated facts that have no practical application." Creationism certainly is interesting and important to many high school students. It is the one topic about which they come to the biology course with strong preconceptions and deep concern. Zuidema seems to assume that high school students are isolated, or can be isolated, from the problems of the society around them. Perceptive teachers are aware that this is not the case; yet, too often our schools, for whatever reason, carefully shy away from involvement in many of the problems that most concern the students, including the creation-evolution controversy. This reticence is one probable reason why so many of our vibrant youngsters, who are turned on by sports, cars, extracurricular activities, social life, dating, and the like, are bored to death with the academic side of school.

Suppose the biology teacher—and the biology textbook—refuse to discuss creationism, as Zuidema wishes. We then leave troubled kids to the mercies of the

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extramural creationists. In this circumstance, who is more likely to reach the kids, evolutionist biology teachers or creationist pamphleteers? We should teach evolution with thoroughness, while at the same time explicitly recognizing the existence of objections to it—whether valid or not. This is what my text tries to do.

I am not alone in holding these views. Earl D. Hanson, a teacher at Wesleyan University, says: "A head-in-the-sand attitude that science textbooks should contain *only* science is dangerously ill-informed regarding the need of an informed public regarding . . . such confrontations as those engendered by the creationist-evolutionist issue" (1980). John Horn, a biology teacher and a witness for the defense in the recent California Segraves trial, said on the witness stand:

> "I have several students who bring their Bibles to class. . . . We discuss it back and forth. . . . I've had students prepare papers on [creation versus evolution], and we've had debates in class."
>
> "Do students have to accept evolution to get a good grade?" the defense asked.
>
> "No, not in my class. . . . A child only needs to understand what is presented, not believe it" (Hilts, 1981).

At San Diego State University, Frank Awbrey and William Thwaites teach a course in creation-evolution about which Zuidema also has strong reservations (August 11, 1980). Leading creationists are invited to the class to present their views, to which the instructors respond. The course was instituted after a student gave a paper on creationism in another biology class. To the shocked amazement of the other instructor and his colleagues, a large part of the class was persuaded that there was indeed a good case for creation and that the validity of the evolution theory was much in doubt. Thwaites's ironic comment was: "And this was after four years of studying scientific biology!" When Thwaites and Awbrey initiated their course, there were objections from their evolutionist colleagues. After several years, according to Thwaites, the critics have finally come around to the view that offering this course is both appropriate and useful (Thwaites, 1981).

A final illustration comes from my own experience. Several months ago, I taught evolution as a guest teacher at Ottumwa High School in Iowa. In one class, about two-thirds of the way through the discussion, a girl who had been silent until then raised her hand and said bluntly, "I think evolution is a crock." I asked her why she thought so. A dialogue ensued, which the rest of the class followed with absorption and with occasional interjections. Just before the bell, the girl who had initiated the exchange said with some astonishment, "Gee, you've made me think about this."

That, of course, was my intent. Like Horn, I never require that students must agree with my ideas and beliefs, even were such a demand feasible. I have no right to expect this; the students' minds are their own. All that I ask—all that I *can* ask—is that students try to acquire accurate information bearing on the ques-

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tion at issue and then think rationally about the question and the evidence. The students have every right to their own ultimate conclusions.

I have already noted that my text, which is used in Ottumwa High School, reminds students of their citizenship obligations. This point is not an academic abstraction but is a realization of a concrete necessity and a forecast of things to come, as is evident in Iowa, particularly in Ottumwa. For five years the state has been the focus of a sharp creationist-evolutionist confrontation (Gerlovich, 1980). The state senator from Ottumwa was a sponsor of the 1979 creationist bill. In the most recent election, Ottumwa chose a new state representative, who is now on the legislative committee which has been charged with the issue and who is pro-evolution.

This situation is not unique to Iowa. These matters concern young people everywhere. Is the girl, whom I previously quoted and who will soon reach voting age, likely to be a better-informed citizen had she not participated in the creation-evolution discussion that I led?

Strategies for Dealing with Creationism

Creationism is troublesome because of its persistence as a significant public issue. For years scientists simply ignored it. They regarded any concern with it as unimportant, unworthy of their attention, a possible intrusion into their valuable research time, and likely to involve them in unpleasant and unwelcome political activity. As a result of the scientists' inertia in this area, as well as the creationists' own shrewd campaigns, creationism flourished.

In the past few years, many scientists have come to realize their error. In growing numbers they write and speak on creationism, deal with it in their courses, debate creationists, lobby legislators, and carry on similar defensive activities. These activities have helped to resolve creation-evolution issues in several state legislatures. In the past two years, of creationist bills in about twenty states, only the Arkansas bill was passed, and it is now being challenged in a lawsuit.

Yet, creationism is almost untouched in its area of greatest strength—local communities and local school systems. In this arena, creationists have no need of supportive legislative enactments or of court decisions. Let me give an example of how things work. In a community that I know well, the president of the school board told two successive biology teachers that they had every right to teach evolution—but not in that district if they wanted to keep their jobs. The first teacher left for another job at the end of the school year. The other is still there, unhappily *not* teaching evolution. Community pressure does the trick. In how many thousands of school districts across the nation do similar conditions prevail?

Although the creationists lack any substantial support in the scientific com-

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munity, they claim the support of at least half of the general public (Bliss, 1981). From my own observations around the country, I find the creationist claim persuasive. In 1942, Oscar Riddle found that half of the nation's high schools did not teach evolution. In the 1960s, Troost found that, of 363 high school teachers he surveyed, half said that they taught evolution only as one of several alternative theories of the origin of life (Henig, 1979).

How can the scientific and educational communities deal with such aberrations with respect to evolution? It seems to me that the ultimate answer must be education—public adult education, better teaching in our schools and colleges, better teacher training. Topics treated should include: the nature of science; the nature of creationism; what evolution is, what it is not, and the evidence on which it stands. Discussion of creationism is an essential component of such a program. Creationist propaganda is effective and cannot be countered by indirection; it must be dealt with directly and explicitly. For this reason, I feel that efforts by Zuidema and others to constrain discussion—*discussion*, not *support*—of creationism are not only ill-advised but are self-defeating as well.

Discussion Does Not Mean Approval

I support evolution as the best available explanation of the variety of life on earth. But I do not treat it as untouchable dogma that cannot be examined or criticized. Evolution can stand up to any thorough, honest, and searching inquiry —including criticism from creationist sources. Zuidema characterizes any such inquiry as support for creationism. His objection is idiosyncratic. Would any competent working scientist object to rejection of authority and dependence on the evidence—characteristics of science that I stress? Do scientists assert the perpetual immutability of *any* scientific theory? Science endeavors to be open, skeptical, and self-correcting. Its theories are subject to criticism from any source, and, when the theories fail to respond to criticism, they cease to be scientific.

In controversial areas, science is skeptical enough to suspend judgment, sometimes for centuries. But science does not sit on the fence forever. As evidence accumulates, a consensus develops that certain theories have been adequately verified, such as the round earth and the heliocentric solar system; these theories then enter into the body of scientific knowledge and into school curricula. The alternatives—the flat earth, the geocentric universe—are rejected as unfounded. Schools do not teach them, and few people are unhappy about this. Any individual who wishes to hold to the obsolete alternatives is perfectly free to do so, and small numbers of people are so committed.

Creationism is a somewhat special case. Someday, perhaps, it will join the many other obsolete hypotheses that have been discarded as prescience or nonscience by the public. I do not expect to live to see that distant day. On the basis

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of overwhelming evidence, science long ago rejected creationism as an unverified and obsolete hypothesis. Creation-evolution is no longer a *scientific* issue. But creationism's many devotees do not accept the consensus; they keep creationism very much alive as a significant *public* issue. Students, especially, do not know the evidence upon which science bases its consensus. Therefore, with each new generation of high school students, the issue must be addressed anew and the evidence again examined critically.

Science today has acquired an unfortunate public image as dogmatic, authoritarian, and elitist, and it thereby suffers. Stephen Gould comments that the irresponsible behavior of some scientists has contributed to this poor image (1981). It seems to me that the schools can help to restore the more authentic image of science as an open and responsive discipline. Many good biology teachers, including Horn, use the creation-evolution controversy as a medium for teaching this concept of science. The material in my book is designed to facilitate such classroom discussion; teachers tell me that the material works.

Of course, a high school class has limited time to spend on any single topic. It is especially difficult to provide for exhaustive investigation and discussion of a controversial issue. The extent of the discussion must vary with the interest and background of the students and the judgment of the teacher. To provide a substantial amount of material in condensed form, I resorted to the comparative table that distresses Zuidema. As a pedagogical device, the table is excellent; as a graphic device, it is unfortunate. Its two-column format makes it look like the creationists' two-model pattern—which it is not. The table does not equate creationism and evolution as alternative theories of equal weight. It does quote arguments against evolution and responses thereto—a very different thing.

Taken out of the context of the chapter of which it is an integral part (where else do we see the out-of-context technique at work?), the table may be misrepresented as support for creationism. Then creationists, such as John N. Moore, gloat, and pro-evolutionists, like Zuidema, rage. To obviate such misunderstandings, the table will not appear in future editions. I will try to achieve the same pedagogical end through textual discussion.

Religious Views

One pair of arguments cited in the table deals with religious views. Zuidema asserts that no discussion of religion belongs in a biology textbook (August 18, 1980). He adds that various evolutionists with whom he has worked rarely talked about their religious views. I accept the latter statement, and I feel that I should have made the point myself.

On the other hand, it would not be difficult to compile a long list of respected evolutionist scientists who have publicly stated their religious faith in a

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creator who works through the process of evolution and another list of clergy and other devout persons, of many faiths, who have put themselves on public record as accepting evolution and opposing the creationist "equal time" doctrine. I will spare the patient reader such lists, but I would like to cite just two names. Gould pays a gracious tribute to his teacher and friend, Kirtley Mather, as a distinguished evolutionist and an outspoken Christian (1981). Also, in April, 1981, biologist Kenneth Miller debated creationist Henry Morris at Brown University. Miller eloquently described his Catholic faith as entirely consistent with his commitment to science and his acceptance of evolution.

These private religious convictions are entirely outside of science, which deals only with the natural world and never with the supernatural. But they are very relevant to creation-evolution *as a public issue.* Many creationists resort—frequently, widely, and effectively—to the argument that evolution is unavoidably synonymous with atheism. This defamatory charge should be responded to wherever and whenever it surfaces. Science is neither theistic nor atheistic; religious belief or disbelief is simply not on its agenda.

Is a high school textbook a proper place to deal with these matters? I think it is, always provided that they are relevant to a scientific or quasi-scientific issue and that they are dealt with objectively and factually. The kids have already heard the creationist statement; why is it not proper to also expose them to the response of *some* evolutionists? The courts have carefully distinguished between objectively and dispassionately *teaching about* religion and *indoctrinating* in a particular religious faith. The former is acceptable and proper in a public school; the latter is unconstitutional and unacceptable. My brief treatment abides by this legal and ethical doctrine. Teachers have found the treatment helpful in clearing the air on a sticky subject.

Resolving Differences

Zuidema is a battle-scarred veteran of the struggle to defend the integrity of science. Yet, in view of his limited teaching experience, I find his *obiter dicta*, as to what does and does not belong in a textbook, to be unrealistic and inappropriate.

Zuidema has generously mentioned my involvement in the defense of evolution. We are on the same side, although we differ as regards how best to achieve our common aim. He has done a service by raising some issues that are significant for science policy and science teaching. It would be well if we could resolve our differences in technique. Divisiveness in the still-thin ranks of pro-evolutionists is not helpful.

The cover letter, which came to me from the editor along with Zuidema's manuscript, was signed with the hope: "Yours for a lively journal." I echo these

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words. Open minds and open discussion are essential to the progress of science and education.

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The Alabama Creation Battle

John Schweinsberg

The sponsorship of scientific creationism in Alabama and its major opposition both came from Huntsville, a city with a population of 145,000, whose primary industry is technical work for NASA and the U.S. Army. It is also the site of two state-supported colleges—the University of Alabama in Huntsville (UAH) and Alabama A & M University.

The organized creationist push in Alabama started in 1980 with the formation of Alabama Citizens for Quality in Education by Byron Tabor, a fundamentalist minister, and his wife. The group was successful in getting a creationist resolution passed in December by the Madison County School Board. In January, they received a more negative reaction from the school board of neighboring Huntsville, where two citizens spoke out against the resolution.

The creationist group next approached the Madison County legislative delegation at a citizens' forum sponsored each year by the American Association of University Women (AAUW), preceding the opening of the legislative session. The creationists packed the Huntsville City Council chambers with 250 supporters and followed up their presentation to the legislators with a rally at the court house. A standard model bill was subsequently introduced in both houses by Senator Albert McDonald and Representative Frank Riddick, both of Huntsville. Byron Tabor registered as a paid lobbyist in favor of the bill.

As a result of the publicity, three independent but cooperating opposition groups appeared in Huntsville. Dr. William Morgan, a United Methodist minister, collected the names of fifty local clergymen who opposed scientific creationism. He wanted to demonstrate that the issue was not a matter of Christians v. atheistic scientists. Dr. Jeffrey Hindman, an ophthalmologist, represented a group of fifty medical doctors who financed the publication of anti-creationist newspaper ads. He and Dr. Morgan organized an anti-creationist forum, held at the First United Methodist Church and attended by 350 people. Speakers included four Christian clergymen, a representative of the Jewish community, and three members of the science faculty of UAH. It was this meeting that showed the press and the public that there was actual opposition to the bill from responsible members of the community. Prior to it, nearly everyone seemed to be favoring the

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John Schweinsberg has a M.S. in mathematics from the University of Michigan and has worked in computer software for Bell Telephone Laboratories and Science Applications, Inc., for a total of sixteen years. He was one of the leaders in the Alabama fight.

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legislation. The broadcast and print media picked up on this event immediately and gave it all the coverage it deserved.

This author organized the Alabama Coalition for Responsible Education, which circulated petitions and generated letter writing to the local legislative delegation. A study committee composed of scientists from UAH and NASA studied creationist books. It wrote a negative report about the proposed bill, creationism in general, and the book, *Origins—Two Models*, by Richard Bliss, the only creationist textbook approved for use in Alabama. Another committee prepared a collection of information for the education committee, including these reports and the study performed by the Iowa Department of Public Instruction.

An open hearing was held by the House Education Committee on March 18 with the Senate Education Committee invited. Since approximately thirty people appeared to speak on each side, the chairman, Peter Turnham of Auburn, allowed only two major speakers for each side. Subsequent speakers were limited to three minutes. The lead speakers for the creationists were Richard Bliss and Wendell Bird, lawyer for the Institute for Creation Research. The lead speakers for the opposition were Dr. Hindman and Dr. Nicholas Hotton, research curator in paleontology at the Smithsonian Institution, whose trip was financed by the medical doctors. Additional opponents included six clergymen, faculty members from the University of Alabama and Auburn University, and technical people. The hearing lasted six hours.

The sponsors of the bill had apparently not expected such extensive opposition and negotiated a "compromise" with state education officials. The weakened bill would "encourage the equitable treatment" of scientific creationism and evolution rather than require them to be taught equally. Its major provision was to train science teachers in scientific creationism. The bill required science texts to clearly state that evolution is a theory and "encouraged" the inclusion of creationist materials in school libraries.

The substitute bill was accepted and passed without opposition by the Senate Education Committee. In the House Education Committee, both versions were filibustered to death by Robert Albright of Huntsville, a former biology teacher. Creationist hopes remained alive when Riddick announced his intent to maneuver the potential Senate-passed bill to a more favorable House committee. McDonald used his position as chairman of the Senate Rules Committee to place the bill on a priority calendar intended for noncontroversial bills. The tactic failed, and the bill reached the floor late in the session, when it could be forwarded to the House only by a suspension of the Senate rules. Three objecting senators could prevent this. When it was obvious that the necessary opposition existed, the bill was withdrawn without a vote.

The battle is not over, however. Special sessions of the legislature on reapportionment and an education budget will be held later this year, allowing for further attempts to push creationism.

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News Briefs from the Editor

Creation Battles

Arkansas: A coalition of church leaders, educators, individuals, and organizations filed a suit in U.S. District Court on May 27, 1981, challenging the new Arkansas "equal-time" creation law. Two-thirds of the plaintiffs are ministers or other leaders in Protestant, Catholic, and Jewish organizations. Other organizations involved are the National Association of Biology Teachers, the National Coalition for Public Education and Religious Liberty (National PEARL), and the Arkansas Education Association. The American Civil Liberties Union is handling the case. Mentioned among the reasons for the action are these facts: the legislative process used in passing the law was hasty with no hearings in the State Senate and only a fifteen-minute hearing in the House, the bill was drafted by an outsider working through a creationist organization, the law is religiously sectarian, the law abridges the constitutionally protected academic freedom rights of both teachers and students, and the law is unconstitutionally vague with internally inconsistent provisions. The Arkansas law is a word-for-word copy of the model bill, drafted principally by Wendell R. Bird of the Institute for Creation Research and pushed by Paul Ellwanger's Citizens for Fairness in Education. (A "flat-earth" version of this same bill appeared in *Creation/Evolution*, III.) *Creation/Evolution* is assisting in the effort to fight this bill by providing the ACLU with background information. Science and religion experts are needed for witnesses in support of the case. If you are interested, write to Jack D. Novik at ACLU National Headquarters, 132 West 43rd Street, New York NY 10036, or call (212) 944-9800.

Colorado: SB 394, a creation bill, died in the Senate Education Committee in April by a vote of eight to one. But Senator Sam Zakhem, sponsor of the bill, has not given up after two attempts. He has lined up radio appearances to promote his creation arguments.

Florida: SB 296 and HB 178 were both hopelessly bottled up in committee where they died in June. A last minute effort to bring this creationist legislation out of committee was made when two state senators tried to add it onto a bill dealing with disposal of old textbooks. The amendment was ruled out of order for not being germane to the bill. Meanwhile, Florida school boards are still having trouble with the issue.

Iowa: SF 97 and SF 280 were introduced in January and February respectively.

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SF 280 is the Bird model bill with the "Legislative Findings of Fact" removed. No hearings have been held, and no reports concerning this creation legislation have been written. Further action cannot be taken in the first session, but the bills are eligible for further consideration in 1982 during the second session of the current legislature. Senator Ray Taylor is sponsor of both bills.

Louisiana: After the first creationist bill was killed, a legislative committee concluded hearings on two new bills. The committee reported to the full senate on a permissive propagandist bill that doesn't change present legalities. The bill mandates nothing. It permits, but doesn't require, teachers to teach creationism, evolution, both, or neither. Nothing more has been heard on this one.

Michigan: The Michigan chapter of the Moral Majority, headed by the Reverend David A. Wood of Grand Rapids, has been encouraging citizens and parents to demand that school boards in the state introduce creationist textbooks in classrooms and libraries. In March and April, school boards in several counties, including Berrien, Cass, Kalkaska, and Antrim, began being pressured to include the creation story in the science curriculum. In response, the Voice of Reason, a Michigan-based group founded by Rabbi Sherwin Wine, started training its members to oppose introduction of creationism into public schools. They held two science seminars on the subject in March. The Bellaire school board in Antrim county is reviewing creationist textbooks for possible placement in the school library.

Oregon: Although HB 2633, a verson of the Bird bill, was tabled in committee after a public hearing, this has not ended creationist action in Oregon. Petitions were circulated in March for a May district referendum on teaching scientific creationism in Medford public schools. The lead promoter of the petition drive, Tom Kindell, runs a teaching ministry from Faith Bible Center and is a science speaker for the Moral Majority. He feels that the majority of Medford residents would favor equal time for creationism and would be willing to mandate it through the ballot. Kindell failed to get the required 4,650 signatures by deadline time, but has stated that he may aim for the September election.

Meanwhile, in April, three people in Grants Pass filed a preliminary petition for a statewide intiative. This initiative would require balanced presentation of scientific creationism and evolution in *all* Oregon public schools. If the 1,994 signatures can be collected and verified by August 11, 1981, the initiative can appear on the September 15 statewide ballot. Whether or not it is legal for an initiative to be used to dictate school curricula is a question that remains up in the air. Richard Bliss from ICR appeared on the scene in May to help the effort along. Kindell has stated that this voter referendum approach to mandating creationism is "a precedent for the entire nation," one that has never been done before. However, back

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in 1964, a Reverend Moore had attempted the very same idea in Arizona. And, even though he used deception by labeling his law as a measuue to prohibit the teaching of "atheism" in the public schools, he still failed to get the required number of signatures.

Texas: HB 1901 was considered in the House Committee on Public Education in May. Considerable pro and con testimony was heard. The measure was then referred to a subcommittee for further study, where it quietly died. Forty-seven politicians went on record as supporting the bill.

Various states: Bills have recently died in committee in Illinois, Indiania, Mississippi, Missouri, Nebraska, South Carolina, South Dakota, and Washington. School boards in several towns in South Dakota have rejected demands that the teaching of creationism be mandated in the schools.

Society Actions and Miscellaneous

African safari: Biologist Roy P. Mackal of the University of Chicago, Los Angeles engineer Herman Regusters, botanist Richard Greenwell of the University of Arizona, and crocodile expert James Powell plan a safari to the Congo and Zaire in search of a living brontosaurus. Following claimed first-hand reports from pygmies and other natives of encounters with a bizarre creature twice the size of an elephant, they will enter uncharted African jungles, which have changed little in seventy million years.

This creature, called ***mokele-mbembe*** by the natives, supposedly fits the description of a brontosaurus. Tribesmen who were shown an artist's drawing of the dinosaur have agreed that this is what they saw. The brownish-gray animal apparently has short, thick legs, weighs perhaps nine to fifteen tons, and stretches some thirty-five feet in total length. One of these animals was reported killed by pygmies in 1959. The plan is to take photographs. The expedition has the offical support of no institution or foundation. Though the explorers are not creationists, the *Creation Research Society Quarterly* has recently taken an interest in the project. It even seconded the reports by claiming that a Mr. Burge Brown saw three plesiosaurs swimming off Bynoe Harbor, near Darwin, Australia. "An apparently similar animal was fished up, already dead, off New Zealand about three years ago." In the creationist film, *The Great Dinosaur Mystery*, a belief that the Loch Ness Monster is a plesiosaur has been expressed as well. This leads the *Quarterly* to conclude, "So maybe these reports of somewhat similar land-dwelling creatures [the alleged brontosaurus sightings] are not so surprising after all."

Clark University: On June 6, 1981, the biology and education departments at

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Clark University held a Conference on the Teaching of Evolution. The purpose was to help teachers of science subjects deal with the creation-evolution controversy. Teachers were introduced to the history of evolutionary theory, recent developments in the field, and the pedagogic and civil liberties issues relevant to the teaching of evolution. Professor Charles S. Blinderman of the Department of Engish coordinated the conference.

National Association of Biology Teachers: In January, the NABT started a publication called *Scientific Integrity* to "maintain the integrity of science and science education." It is edited by Wayne Moyer and gives up-to-date information on creation conflicts in various states, republishes short articles, gives listings of articles published elsewhere on the controversy, and keeps one abreast of new statements issued by science societies. It is a four-page newsletter published bimonthly and costs five dollars a year. Write: NABT, 11250 Roger Bacon Drive #19, Reston, VA 22090. The publication is free to NABT members. The NABT is also starting to circulate its own pamphlets rebutting creationist principles for the benefit of teachers and others. Furthermore, it has established the Fund for Freedom in Science Teaching to engage in litigation.

Society for the Study of Evolution: The Society has established an education committee to assist in defense of

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evolution in the schools. Not only will the committee prepare an official statement but it will collect helpful materials such as legislative transcripts, legal decisions, and creationist publications. The committee will also prepare a list of experts on evolution who will be willing to serve as witnesses and spokespeople. The committee is chaired by Dr. John A. Moore of the Department of Biology at the University of California, Riverside.

Polls

The *San Francisco Chronicle* conducted a phone-in poll on March 11 asking for a yes or no answer to the question, "Should the biblical version of creation be taught in science classes?" Out of 13,512 callers, 73 percent said "no" and only 27 percent said "yes." This is a reversal of the results creationist polls frequently report. The poll was in reaction to the California Segraves trial.

Another newspaper poll, this time by the *Detroit Free Press*, was also conducted in March. Readers were asked if they favored the Arkansas law, which compells the state's public schools to teach the two models. The results were similar to those in San Francisco with 71 percent voting "no" and 29 percent voting "yes."

A supposedly more scientific survey, conducted by *The California Poll*, was made in April, and the results were released on May 14. The questions were asked over the phone to a representative cross section of the California adult public. The questions were as follows:

> Have you seen or heard anything recently about a court case in California regarding the theory of evolution and the biblical version of creation? [81 percent answered "yes"]
>
> Well, as you know, the theory of evolution holds that mankind evolved over the years from lower forms of life. This is different than the biblical version, which maintains that mankind was created directly by God. Which view do you happen to believe in? . . . [39 percent believe in evolution; 49 percent believe in creation; 12 percent had no opinion]
>
> Right now, California public schools teach the evolution theory in science classes. Do you think the public schools should also be required to teach the biblical version of creation in their classes or not? (If yes, ask:) Should the public schools teach the biblical version instead of the evolution theory or should it teach the biblical version along with the evolution theory? [40 percent do not want to require schools to teach creation; 6 percent want creation taught instead of evolution; 50 percent want creation taught along with evolution; 4 percent had no opinion]
>
> Do you think the biblical version of creation can be taught in public schools

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and still meet the constitutional requirement of separating church and state? [61 percent said "yes"; 32 percent said "no"; 7 percent had no comment]

The flaw in this survey was spotted by Edd Doerr, editor of *Church and State* magazine. The questions used referred to "the" biblical version, as if there were only one. They did not specifically state that the creation model for which creationists seek equal time is one that demands a literal six-day creation occurring six- to ten-thousand years ago followed by a worldwide flood. Many who support a "biblical" version of creation see it as compatible with evolution, or at least an old earth, and may have wanted equal time for *that*. As Doerr noted, the respondents "were presented with an either-or choice that excluded the vast middle of the country." One can further note that even the "scientific" creationists were treated unfairly. They say they do *not* want the "biblical" creation model taught in public schools, but only the "scientific" model. To our knowledge, no poll, whether conducted by creationists or others, has asked the questions in a manner that would get an accurate and informed public reaction on the real issues at stake. (Jerry Falwell's poll is a particularly obvious example. By answering it, however, you will not only get to voice your view but will receive a free book in the bargain. See page 36.)

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Film Review:

Theories on the Origin of Life

EBF Corporation Biology Program, Unit 5, Heredity and Adaptive Change. Dr. Cyril Ponnamperuma, consultant. Encyclopedia Britannica Film Corporation, 1969. (14 minutes, 16mm color, sound.)

Reviewed by John R. Cole, assistant professor of anthropology at the University of Northern Iowa in Cedar Falls.

The creation-evolution controversy was returning as a hot political and educational issue when this film was made a dozen years ago. Today the issue is hotter yet with creationists demanding "equal time" in the classroom. As a result, this film continues to look tempting to teachers seeking out a competent comparison of theories that would objectively demonstrate the superiority of evolution on the basis of evidence, logic, and theory. I certainly had trouble booking it.

Since most teachers would consider a creationist-produced film suspect because of its prejudiced source and since creationists logically reject many standard scientific presentations on the same grounds, a commercial film *might* be able to solve the dilemma—or at least satisfy a teacher that it tries to be fair. This film does not.

Striving vaguely to be objective and inoffensive, it succeeds only in being superficial. It clearly favors evolution, but the only reason a viewer would be convinced to agree is because the producers are known to be trustworthy. Divine creation, evolution, spontaneous generation, and cosmogenesis are the four theories examined. Creation is treated in a simple manner by briefly showing Michaelangelo's version and by noting that people have believed it. An outer-space origin of life via "spores" blown to earth or carried by meteors is duly noted as unproven. Evolution is said to be based on fossil evidence (but not explained at all), and 1953 Stanley Miller experiments are shown passing electricity through the chemicals of early earth history to produce amino acids. Only spontaneous generation is treated in detail. Maggots are shown to come from flies, and microorganisms from airborne contamination produce living cultures in a recreation of Pasteur's famous experiment.

Unless one needs to illustrate the weakness of spontaneous generation, this film is of little use. Portentious music and a ponderous narration that sounds like Orson Welles on a bad day further contribute to the film's inadequacy. It is best, therefore, that college and high school teachers seeking to deal effectively with the creation-evolution controversy avoid this item.

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Letters to the Editor

In recent issues of *Creation/Evolution*, Stanley Freske and Robert Schadewald have listed three of the excuses creationists offer as to why starlight coming from millions of light-years away does not disprove their claim for a young universe. The three listed were: the creator placed the photons of light from the stars close enough to the earth so we could look up and admire his creation; light traveled at infinite speed at the time of creation, but has since slowed down; and material objects exist in Euclidian space, but light travels in Riemannian space with a radius of only five light-years.

However, there is one that they missed. Dr. Theodore Rybka, research associate in physics at ICR, addressed the San Diego State University creation-evolution class in April 1980 and offered a fourth explanation. His argument was for a smaller universe altogether. While scientists generally assume that the lower brightness of stars and galaxies means they are further away from us, Dr. Rybka proposed a model wherein this evidence applies only to stars and galaxies we can measure directly. Beyond that distance, decreasing brightness actually means the stars are comparatively decreased in size.

As a direct analogy to Dr. Rybka's model, we can imagine a row of telephone poles along a road. They appear smaller as they go into the distance. But are they really going into the distance? Not necessarily. A person walking down the road could discover, instead, that they are really shorter and shorter poles. This means a person could walk down a line of poles and find one of a size he'd like to use as a toothpick.

If Dr. Rybka is right, someday we may be able to go out and bring back galaxies to hang up in our living rooms. Not only does this model ignore a wealth of other evidence that galaxies don't shrink with distance, but it also implies a malicious creator who has set out to fool us.

Dr. Frank Awbrey
Biology Department
San Diego State University

I enjoyed Stan Freske's article in *Creation/Evolution* IV on R. G. Elmendorf and his $5000 challenge to evolutionists. Perhaps you're not aware that alternative scientists have a long history of making such challenges. Like Elmendorf, they never voluntarily pay off, since there's absolutely no way to convince them that they're wrong. Consider the case of John Hampden.

In January of 1870, British flat-earther John Hampden placed an advertisement in *Scientific Opinion* offering £500 to anyone who could demonstrate the rotundity of the earth. Two things were unusual

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about Hampden's challenge. First, it was in the form of a bet rather than an offer of a "reward"; second, Hampden was foolish enough to leave the decision up to an independent judge—an error which (to my knowledge) no subsequent alternative scientist has made. Evolutionist Alfred Russel Wallace accepted Hampden's challenge. He won the battle (money), but he lost the war as Hampden persecuted him for the rest of his life. (Readers interested in details of this fiasco can see my article, "He Knew Earth is Round, But His Proof Fell Flat," in the April 1978 *Smithsonian*.)

As I pointed out in *Creation/Evolution* IV, in my article on the Moon and Spencer paper, the Koreshans of turn-of-the-century Chicago taught that the earth is a hollow sphere and that we live on the *inside* of it. I didn't mention that Cyrus Reed Teed (Koresh) had a standing offer of $5000 to anyone who could disprove the "Koreshan Cosmogony." No one ever collected.

In the 1920s, Wilbur Glenn Voliva of Zion, Illinois, had a standing offer of $5000 for proof that the earth isn't flat. No one ever collected from him either.

Such offers have backfired. In the notes to the 1957 edition of *Fads and Fallacies in the Name of Science*, Martin Gardner told of a challenge issued by a German alternative scientist. Patent attorney Godfried Bueren offered 25,000 marks to anyone who could disprove his hollow sun theory. The German Astronomical Society accepted his challenge. When Bueren refused to pay off, they took him to court and won.

A similar and more pernicious case is pending as I write this. The Institue for Historical Review, an anti-semitic group in California, claims that the Holocaust is a hoax. They offer $50,000 for proof to the contrary. Mel Mermelstein, a survivor of Auschwitz, accepted the challenge. When they didn't pay off, he took them to court.

If Mermelstein wins his case, it will set an important precedent. I hope that, on that very day, Stan Freske will file suit against Elmendorf. Forcing Elmendorf to pay off won't silence his braying, but it should muffle it a bit.

Robert J. Schadewald
Rogers, MN

Editor's note: Elmendorf's challenge may not be as winable as some of the others. This is because Elmendorf defines evolution in such a way that one would have to prove a "vital force" or perpetual motion in order to prove that evolution doesn't conflict with the second law. He might keep his money, because he is challenging a strawman instead of science.

One might be better off seeking the $1000 reward of Susan and Robert Sassone: "For proving the validity of any reason why population growth must be limited within the next century." These people, along with a growing number in the religious New Right, reject the notion of

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a population problem. And, to show their confidence, the Sassones declare in their challenge that any lawsuits over the reward money are to be tried in a court closest to where they live. But if you think winning will be easy, you'd best order one of their clever "instant speaker kits" first—complete with slides, graphs, and cartoons. For details, write to them at 900 North Broadway, Suite 725, Santa Ana, CA 92701.

I want to commend you on your journal. As the pendulum of public opinion moves toward religious fundamentalism, it provides a sorely needed antedote. If we can weather the storm, I think the pendulum will eventually swing back the other way. However, the storm promises to be a long one.

As one who teaches physiological psychology, I already am feeling the impact of the current wave of rejection of well-established scientific facts in the attitudes of my students. Discussions of the similarity between ontogeny and philogeny, developments such as encephalization, interspecies generalizability of findings, and various between-species comparisons are beginning to be met with hostility. I have conveyed my concern to members of our biology department and have been met with the yawns and shrugs of indifference. Some of these colleagues have explicitly expressed their unwillingness to deal with the claims of the creationists.

Recently, John Clayton, a creationist high school biology teacher from Indiana, spoke unopposed on campus. The way in which terms such as *proof* were used with abandon in his promotional brochure renders his basic understanding of the principles of science suspect, despite the credentials he flaunts. Religionists such as this man continually attempt to instill the idea that belief in special creation is necessary for belief in God. Since most people find belief in a deity extremely appealing, the success of the association automatically guarantees the acceptance of creationism.

Locally, no biologist or geologist appeared in order to refute the claims of Mr. Clayton. I am not so sure they would have been very successful if they had tried. As you point out, most scientists are narrow specialists and, therefore, ill-prepared to debate the general issues raised by the creationists. This became vividly apparent a few years ago when I was a graduate student at the University of Texas at Austin. Gish and his group engaged in a debate with members of the biology department there. I seem to remember that a poll taken after the debate indicated that over 80 percent of the fifteen-hundred-member student audience thought that the creationists had won. In an apparent gesture of outrage and impotence, most members of the biology department signed the American Humanist Association's *Statement Affirming Evolution as a Principle of Science.*

Candidly, it seems to me that we need refutations of creationism ex-

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pressed in a much more simple way than most of those in your new journal. Creationists oversimplify and, in doing so, distort the evidence; yet, can we not develop simple yet adequate answers to their claims? Until this is done, I am afraid they will have the upper hand with average listeners. Such listeners are taxpayers and voters, capable of influencing the content of instruction in science courses through the senior high school level (and, in certain instances, at the college level). I really believe that we must develop arguments that are comprehensible by the majority and, at the same time, leave their religious sensibilities intact.

Are there no persons who travel about presenting the evolutionist perspective? Given the seriousness of the challenge being posed by the creationists, it might be desirable to find people who are competent and willing to do this.

Obviously, I am experiencing a great deal of frustration in regard to this issue (as no doubt you are likewise experiencing). I am accordingly willing to provide any support that I can.

Garvin Chastain, Ph.D.
Assistant Professor of Psychology
Boise State University

Dr. Sonleitner's article (Spring 1981) did a fine job of summarizing the recent debate over the creationist bill in Oklahoma. Let me add a little to this discussion. When another geologist and I (both working for major oil companies) heard about the proposed bill, we immediately wrote letters to several legislators and circulated a petition against the bill among geologists in our companies. In addition, I prepared to testify at the Education Committee's public hearing.

The point of our letters, petition, and testimony was not just to object to creationism on academic grounds but to emphasize that the principles of "evolutionary science" have very practical applications and that, in fact, the petroleum industry, from whose activities Oklahoma has greatly profited, owes its success to the daily application of these principles. . . .

My impression of the public hearing is that it was little more than a formality. Most of the legislators had their minds made up by then. However, some representatives seemed to have been influenced by the debate between committee members, which followed the public testimony. For this reason, I have come to believe that the best way to influence legislators who may be faced with a creationist bill is not to wait for public hearings but to send letters, petitions, essays or make personal contact as far in advance of any vote as possible. This will at least give them a chance to think things over, knowing that professionals and other concerned voters give no credence to the creationist view of the earth's natural history.

James Cunliffe
Petroleum Geologist
Tulsa, OK

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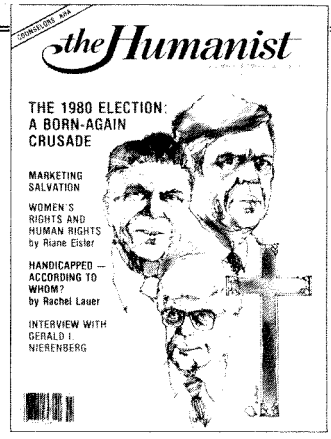
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Contributions of articles to *Creation/Evolution* are coming in from all over the country. Authors who are knowledgeable in some specific area of creationist attack are lending their expertise to the effort of answering creationist arguments. Here, then, are just a few of the subjects future issues will cover:

- Why do creationists reject evolution but support modern physics? Robert Price will clear up this strange paradox in, "The Old-Time Religion and the New Physics."
- How can we effectively answer the sensationalist reports that Noah's Ark actually rests on Mt. Ararat? Robert A. Moore will show us by demonstrating that creationist "arkeology" abandons the scientific approach.
- Have all the radiometric clocks been reset by nature, as creationists contend? Chris Weber will show how modern dating methods continue to be reliable.

Other articles will expose the falacies in the creationist claim that humans walked with dinosaurs along the Paluxy River. Leading scientists who have been quoted by creationists as providing evidence against evolution will speak out and reveal how they have been misrepresented. And details will be presented to show why the whole creation approach, at the root, is unscientific. But there's still more—in fact, too much to list.

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